

an ozone gas supply system connected into the liquid path for introducing ozone into liquid in the liquid path; and

Cl rotor means within the process chamber including a rotor for holding a workpiece and for rotating the workpiece at greater than 300 rpm, while the nozzles spray out liquid onto a surface of the workpiece and form a thin liquid film thereon.

---

#### REMARKS

The claims examined in the May 15, 2000 Office Action (24-32; 35-42; 45-48; and 79-86) and the claims as amended in the Supplemental Preliminary Amendment mailed May 15, 2000, have been cancelled, i.e., all pending claims have been cancelled. New claims 87-102 have been added responsive to the May 15 and July 3, 2000 Office Actions, and to streamline prosecution. These new claims have been carefully prepared to read on the species of Fig. 1. Applicant is preparing to file divisional applications on the species of the other figures.

New independent claim 87 describes an apparatus having a dispersion unit in the liquid reservoir, for increasing ozone concentration in the liquid.

New independent claim 96 describes an embodiment with the spray nozzles below the workpiece and spraying up onto a bottom surface of the workpiece.

New independent claim 102 describes rotor means for rotating a workpiece at greater than 300 rpm while a thin liquid film is formed on the workpiece.

Turning to the prior art, EPO '596 ( Chlorine Engineers ) describes an apparatus for cleaning a substrate having nozzles which spray out a fluid , i.e., water, containing ozone. The mixing of the ozone gas and water is achieved in various ways, including feeding the ozone into a solution tank regulated at a given pressure, to dissolve the ozone into the solution. The pressurized ozone-containing gas is then depressurized in the treating chamber to release fine bubbles of ozone into the treating solution on the wafers ( Page 4 lines 55-60. ). In the embodiment of Fig. 3 of EPO '596, a gas- liquid mixer 13 mixes ozone gas and water.

In contrast, new claim 87 describes an apparatus that uses a dispersion unit within a liquid reservoir, to increase the concentration of ozone in the liquid. EPO '596 does not contemplate a dispersion unit within liquid reservoir. Mashimo '191 describes a gas/liquid mixer, but not a dispersion unit within a liquid reservoir, as claimed.

In EPO '596, the spray nozzles in all embodiments spray out from the sides of the chamber, with the nozzles oriented horizontally. In contrast, in new claim 96, the nozzles spray upwardly, with the spray from the nozzles aimed at the bottom surfaces of the wafers, rather than at the edges of the wafers. This feature allows single side processing of the wafers with less liquid and ozone gas chemical consumption. Alternatively, with an ozone generator of a given output capacity, a higher concentration of ozone gas in the liquid can be realized, as relatively less liquid is needed to form a liquid layer on the bottom surface of the wafers, as opposed to both the top and the bottom in EPO '596.

New claim 102 describes means for spinning the wafers at greater than 300 rpm while the nozzles form a thin film of liquid on the wafer. This rpm is 10 times greater than taught by EPO

'596. Specifically, EPO '596 states, at page 3 lines 39-42, that when applying a thin film of liquid, it is preferable to rotate the substrates at 10-30 rpm. The greater than 1000rpm range given at page 3, line 42, is described as preferable for gasified or misted forms of treating solution, and not for a liquid film as claimed. For a liquid film, the EPO'596 only fairly suggests using 10-30 rpm, a range which is an order of magnitude lower than the claimed 300+rpm range. Since the chemical processing described in the present application relies on diffusion, the layer of liquid on the wafer surface must be kept thin. The claimed 300 + rpm range provides for a thin layer of liquid, whereas 10-30 rpm, as suggested in EPO '596, does not.

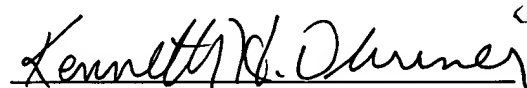
In view of the foregoing, it is submitted that the claims are in condition for allowance, and a Notice of Allowance is requested.

Respectfully submitted,

LYON & LYON LLP

Dated: September 15, 2000

By:



Kenneth H. Ohriner  
Reg. No. 31,646

633 West Fifth Street  
Suite 4700  
Los Angeles, California 90071-2066  
(213) 489-1600 - Fax (213) 955-0440